

NETOPTIX CORP. (formerly Galileo Corporation)

Low-Cost Night Vision Technology

Objects around us emit or reflect electromagnetic radiation, some of it in the form of visible light that we can see. None of us sees well when the light is poor, whether at night, in fog, or under other circumstances of darkness.

COMPOSITE PERFORMANCE SCORE

(based on a four star rating)

No Stars

Seeing in the Dark

If a way could be found to magnify the unseen emissions that remain even in darkness, by passing them through special glasses, then we could see things even when the light is too dim to sense objects with the naked eye.

... a much less expensive process to make devices widely available to law enforcement officials and the estimated 400,000 Americans suffering from retinitis pigmentosa ...

Such glasses already exist. They were developed for military use and are quite expensive. High-performance night-vision devices typically cost more than \$1,000 — too much for general consumer use.

This ATP project with Galileo Corporation, founded in the middle 1970s to develop microchannel plates (MCPs), aimed to develop a much less expensive process technology that would make night-vision devices widely available to, for example, law enforcement officials and the estimated 400,000 Americans suffering from retinitis pigmentosa (night blindness). Another potential use of the technology is in detector components for highly miniaturized analytical instruments. Funding from the ATP enabled Galileo to

perform research to develop the new fabrication processes and higher performance prototype MCPs unable to do and helped the company form alliances with research partners and contractors.

New Electron Multipliers

The ATP project involved the development of new kinds of electron multiplier devices based on the same kind of manufacturing technology used in semiconductor fabrication. An MCP is a flat, usually disc-shaped array of closely packed microscopic tubes that act as tiny amplifiers. Electrons, photons, or ions entering one side of the plate trigger a cascade of thousands of electrons out the other side. MCPs form the heart of image intensifiers used in night-vision and scientific devices and electronic imaging systems. MCPs are currently made using glass-working techniques developed for producing fiberoptic bundles. The process has been improved greatly over the years but has reached its limits in terms of further cost reductions and performance improvements.

Galileo's ATP project abandoned the glass-fiberoptic production approach to MCPs and instead used the photolithography, dry-etch, wet-etch, and thin-film deposition technologies developed by the semiconductor industry to develop improved MCPs. The company succeeded in the technical goals of the project, developing new fabrication procedures and using them to demonstrate prototypes of working, high performance electron-multiplier devices.

To develop fundamentally new, lower-cost fabrication processes for and prototypes of higher quality microchannel plates (MCPs) — which form the heart of image intensifiers used in night vision — to enable wider use of the technology, including applications for the estimated 400,000 Americans suffering from retinitis pigmentosa (night blindness).

Duration: 4/1/1993 — 5/31/1995

ATP Number: 92-01-0124

Funding (in thousands):

ATP	\$1,910	57%
Company	<u>1,428</u>	43%
Total	\$3,338	

Accomplishments:

Galileo developed new processes for fabricating MCPs and other types of electron multipliers, using techniques from semiconductor fabrication, and used the new processes to produce prototype MCPs. As evidence of these accomplishments, the company:

- received four patents for ATP-related technology: "Method for Fabrication of Discrete Dynode Electron Multipliers" (No. 5,618,217: filed 7/25/1995, granted 4/8/1997), "Method for Fabrication of Microchannel Electron Multipliers" (No. 5,569,355: filed 1/11/1995, granted 10/29/1996), "Microfabricated Electron Multipliers" (No. 5,568,013: Filed 7/29/1994, granted 10/22/1996) and "Fabrication of a Microchannel Plate From a Perforated Silicon Workpiece" (No. 5,544,772: filed 7/25/1995, granted 8/13/1996);
- published five technical papers, including one as a dissertation and four in professional journals;
- produced working vacuum-electron multipliers by microfabrication methods; and

- developed thin-film techniques to produce dynode structures that support electron multiplication in MCPs and other channel electron multiplier devices.

Citations by others of project's patents:

See figure 1

Commercialization Status:

No products based on the ATP-funded technology have yet reached market

Outlook:

Prospects for commercialization of this technology are uncertain. Financial difficulties forced Galileo to abandon plans to directly commercialize the ATP technology. The company now is working with the Center for Advanced Fiberoptic Applications (CAFA), a nonprofit consortium charged with commercializing technologies developed by Galileo and other CAFA members. If CAFA can commercialize the ATP technology to benefit people suffering from night blindness, or if the technology is adopted for use in producing miniature scientific and analytical instruments, such as a mass spectrometer on a chip, the broad economic benefits could be very large.

Composite Performance Score: No Stars

Company:

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Sturbridge, MA 01566

Number of Employees: 314 at project start; 240 at the end of 1997

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During the last six months of its 26 month ATP project, Galileo encountered dire financial problems and decided to abandon its original goal of in-house commercialization . . .

Financial Distress

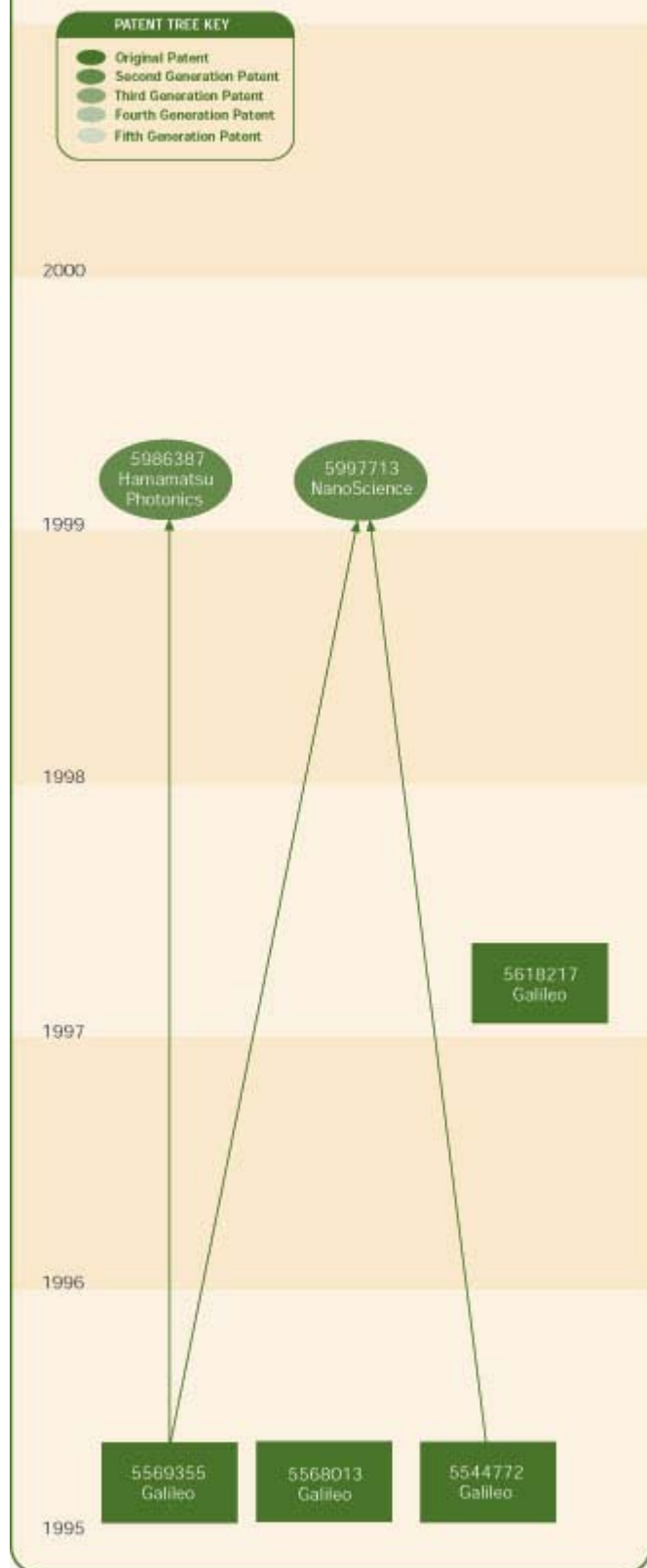
During the last 6 months of its 26-month ATP project, Galileo encountered financial problems and decided to abandon its original goal of in-house commercialization of the new process technologies for electron multipliers. The company has continued to produce MCPs using its earlier fabrication process and sell them. Even though feasibility of the new approach was demonstrated by

the ATP project, Galileo officials reported that another \$5 million investment would have been needed to commercialize the advanced performance MCPs using the new process. They say they could not justify the investment for commercialization, given the company's financial difficulties and the length of time needed to build revenue streams.

Commercialization Potential

At the close of the project, the company entered into an agreement with the Center for Advanced Fiberoptic Applications (CAFA), a new nonprofit consortium charged with commercializing technologies developed by Galileo and other CAFA members, mainly small to medium sized optics companies in the mid-Massachusetts area. Galileo granted a nonexclusive

Figure 1 Patent Tree for Project Led by NetOptix: Citations by Others of NetOptix Patents



NetOptix granted a nonexclusive, royalty-free license of the ATP-funded technology to CAFA.

royalty-free license of the ATP funded technology to CAFA. The principal investigator on the ATP project left Galileo to become section head for micro-electromechanical systems in the CAFA consortium. In addition to licensing agreements, CAFA is pursuing partnerships with a number of companies as an avenue for commercializing the ATP-funded MCP technology, but the chances for commercialization are uncertain at this time.

In theory, it is expected that the technology will reduce the costs of MCP production and improve performance, but these effects have not yet been shown in practice. The prototype demonstration focused on the feasibility of the new process technology adapted from the semiconductor industry to produce MCPs and on improved MCP performance, rather than on their comparative costs. Laboratory tests and calculations suggested that production costs would be lower using the new technology, but no pilot project has yet been developed, so those predictions have not been confirmed. Demonstrated lower costs and improved performance would make it more feasible to pursue new market opportunities for applications to address night blindness.

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In addition, the technology holds further potential that might one day be realized. It is important for miniature scientific and analytical instruments — for example, a mass spectrometer on a chip. The National Aeronautics and Space Administration (NASA) recently awarded a contract to develop components for miniaturized mass spectrometers to CAFA, Galileo, and the Argonne National Laboratory, under which prototypes have been delivered and are now being evaluated. While the NASA contract did not itself involve the use of the ATP-funded technology, extensions to additional contracts could easily do so, because of the need for additional miniaturization. Commercialization of the technology for this application, if it can be accomplished, could also have far-reaching economic benefits.

